combination having an enhanced synergism would be welcomed especially by the flexible PVC industry. Also, because of the end use of articles made from some polymers, many polymeric compositions require the presence of both biocides and heat stabilizers but the use of the organotin mercaptide/mercaptan combination in such a composition is often frustrated by the tendency of the free mercaptan to deactivate a biocide such as the much used OBPA (10, 10-oxybisphenoxarsine).

Zinc salts in general have long been believed to be less satisfactory as heat stabilizers for halogen-containing polymers than the organotin-based stabilizers and, indeed, have lent their name to the catastrophic degradation known as zinc burn. In U.S. Patent No. 3,067,166, Zaremsky teaches the combination of from 0.002 to 0.05 part per hundred parts of resin (phr) of a tin or zinc salt along with a mercaptoacid ester for heat stabilization of halogen-containing vinyl resins. Zinc carboxylates and zinc chloride are said to be typical of the salts that may be used. It is to be noted that the compositions in each working example contain either an epoxidized soy bean oil or a phosphite.

The importance of the epoxidized soy bean oil and phosphite is shown by the work reported at the Japan Chemical Congress in Honolulu in 1979 by Deanin et al and described in "Organic Coatings and Plastics Chemistry"; 40, ACS,(1979). It was shown that although zinc chloride does catalyze the thermal degradation of PVC resins, small quantities (i.e., 0.001-0.01 phr) enhances the effect of epoxidized soy bean oil and alkylaryl phosphites in PVC compositions containing 1 phr each of zinc stearate, a barium soap, and a cadmium soap. The authors also teach that the degradative effect of zinc chloride may be overcome by large quantities of epoxy or

phosphite but that each of them has its own color problems.

With reference to the Deanin article, Bae et al teach in U.S. Patent No. 4,782,170 that an organic triphosphite may form a complex with zinc chloride to provide an effective heat stabilizer for a clear PVC.

Kornbaum teaches a stabilizer for rigid PVC comprising a combination of a thiol compound with from about 0.003 to about 1 phr of an organometallic or metallic halide in U.S. Patent No. 5,166,241. The metallic halide is defined to include zinc chloride. Again, the compositions of each of the working examples make use of an epoxidized soy bean oil.

SUMMARY OF THE INVENTION

It is an object of this invention, therefore, to provide a heat stabilizer composition having the advantages of a latent mercaptan and the synergy of a mixture of a zinc carboxylate and zinc chloride.

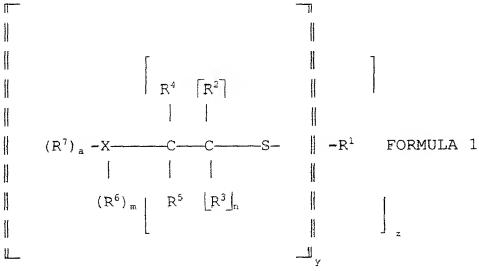
It is a related object of this invention to stabilize rigid, semi-rigid, and flexible PVC resin compositions with a latent mercaptan-containing heat stabilizer composition which is substantially free from the offensive odor typically associated with mercaptans.

It is still another object of this invention to provide a PVC composition and article stabilized against heat by a latent mercaptan in combination with a synergistic mixture of zinc chloride and a zinc carboxylate, with or without an epoxy compound or organic phosphite.

The synergistic mixture of zinc carboxylate and zinc chloride of this invention provides the advantage that the good early color associated with zinc chloride as a heat stabilizer is not compromised by the poor early color associated with zinc carboxylates as heat stabilizers and the

long term performance associated with the carboxylates is not harmed by the presence of zinc chloride, which is notorious for causing the catastrophic zinc burn after an initial good color.

These and other objects and advantages of the invention which will become apparent from the following description are achieved by a composition comprising a halogen-containing polymer and a latent mercaptan having Formula 1:



FORMULA 1

wherein a is 0 or 1, m and n are 0 or 1; y = 1 to 4; when y = 1, z is 1 to 4; and when y is more than 1, z is 1; R^1 is an alkyl, alkylenyl, cycloalkyl, cycloalkylenyl, aryl, alkaryl, aralkyl, aralkylenyl, hydroxyalkyl, dihydroxyalkyl, hydroxy(polyalkoxy)alkyl, alkoxyalkyl, hydroxyalkoxyalkyl, alkoxy(hydroxyalkyl), alkoxy(acyloxyalkyl), alkoxy(polyalkoxy)alkyl, alkoxy(polyalkoxy)carbonylalkyl, carboxyalkyl, acyloxyalkyl, acyloxy(hydroxyalkyl), acyloxyalkoxyalkyl, acyloxy(polyalkoxy)alkyl, benzoyloxy(polyalkoxy)alkyl, alkylenebis-(acyloxyalkyl), alkoxycarbonylalkyl, alkoxycarbonylalkylenyl,